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CASE REPORT

Accidental hanging among children and adults: A report of two cases and review of the literature

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KEYWORDS

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Abstract Accidental hanging is rare. The circumstances of death are sometimes so strange and bizarre. It represents a differential diagnosis with suicidal hanging and even criminal hanging. We report two cases of accidental hanging. The first one occurred with a 7-year-old girl playing with a curtain rope. The second with a thief who was found head-trapped between two bars of a metal outer-door. We summarize the findings of the death scene examination, the forensic autopsy and the world literature concerning death by accidental hanging.

1. Introduction

Accidental hanging is rare, which leads to the difficulty of distinguishing its diagnosis from the diagnosis of suicidal and even criminal hanging. Accidental hangings have a common characteristic that causes death to unsuspecting victims. It concerns children as well as adults mainly in auto-erotic context. This study presents two unusual cases of death by accidental hanging that occurred to a child and an adult in different circumstances.

2. Case reports

2.1. Case 1

A seven-year-old girl was discovered by her mother suspended by a window-curtain rope usually used to play the swing. The rope was fixed to a metal bar in the wall situated 2 m from the ground, it constitutes a simple loop and it does not contain a knot. The body was found in a sitting position with the feet touching the ground. The neck was caught in the loop and the suspension point rising to the left ear, tilting the head to the opposite side. The death occurred on the scene of the accident and the body was freed by the mother in the hope of saving her girl.

External examination showed that the deceased was 130 cm tall presenting an incomplete ligature mark of 0.2–0.6 cm wide, more marked on the anterior and right side of the neck (Figs. 1–3). No other traumatic lesion was noted, mainly defensive wounds. The autopsy revealed a marked asphyxia syndrome associated with small intramuscular haemorrhages on the right sternocleidomastoid muscle (Fig. 4), a small bruise on the posterior surface of the esophagus (Fig. 5) and a bruise at the posterior wall of the right common carotid artery, near the carotid sinus (Fig. 6).

The dissection of the right carotid artery did not reveal an intimal tear. No other cervical injuries were observed, especially in the laryngeal cartilage and the hyoid bone.

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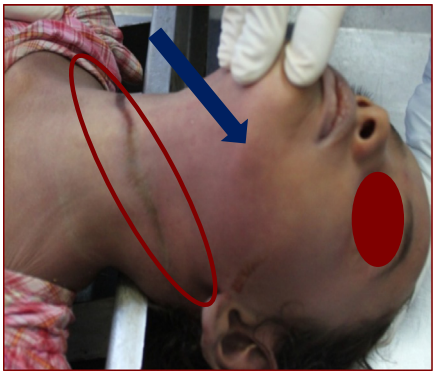

Figures 1–3 The cervical ligature mark in case n°1.

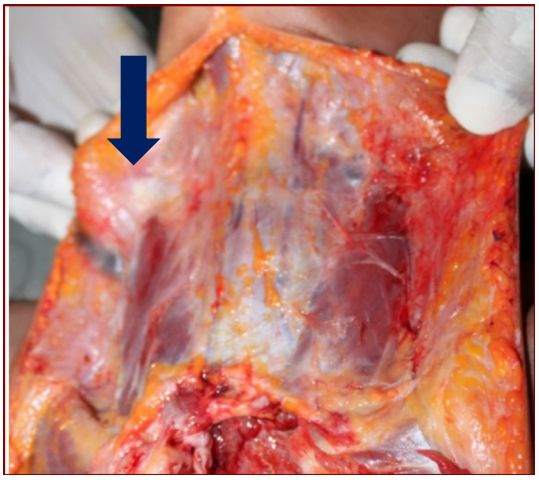

Figure 4 Intramuscular hemorrhage on the right anterior part of the sternocleidomastoid muscle in case n°1.

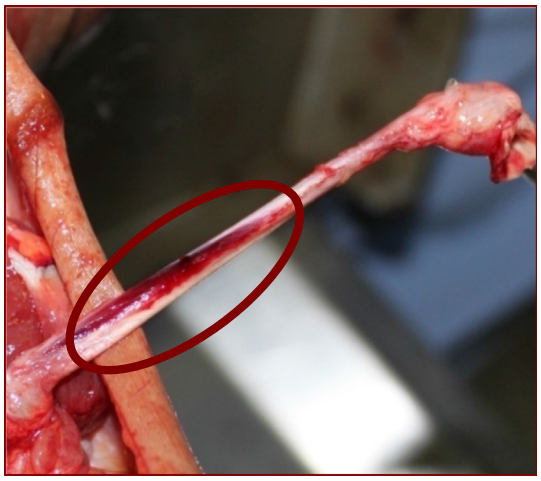

Figure 6 Bruise at the posterior wall of the right common carotid artery near the carotid sinus in case n°1.

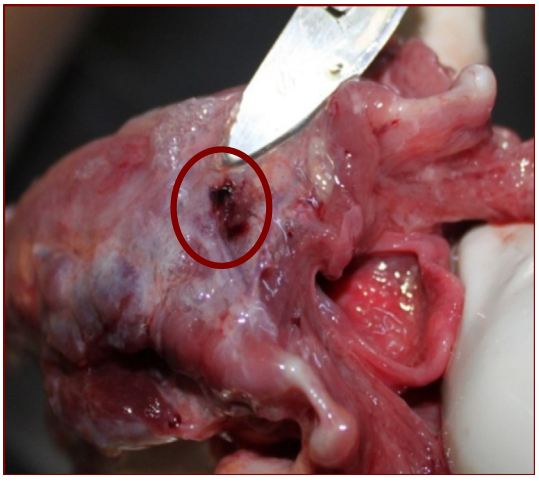

Figure 5 Bruise in the posterior surface of the esophagus in case n°1.

Figure 7 The deceased's position in case n°2.

2.2. Case 2

A thirty-five-year-old man, free from any psychiatric illness, was found suspended by head trapped between two bars of a metal outer-door (Fig. 7). He was a thief who attempted to climb the door at the night. He was trapped, his head wedged between the bars and his feet are far from the ground. The extremeties of the arrow-shaped metal bars did not let him remove his head. Over the time his neck became more and more compressed. The death occurred on the scene of the accident.

The body was discovered in the morning by the neighbors. The police investigation did not find any signs of violence or disorder around the death scene. The bereaved did not report any suicidal intention. The examination of the deceased's clothes did not reveal signs of fight or any biological traces.

External examination of the body showed that the deceased was 164 cm tall and 69 kg in weight. He presented an oblique incomplete ligature mark, prominent in the left anterior side of the neck (Fig. 8). Dark post-mortem hypostasis was noted in the lower areas of the arm and leg of the victim. An abrasion was found just behind the right ear, caused by the tip of the metal bars during the rescue attempts when the deceased tried to remove his head (Fig. 9). No other traumatic lesions were observed.

The autopsy showed a marked asphyxia syndrome associated with ecchymotic infiltration in soft tissue of the neck. The thyroid cartilage and hyoid bone were intact. The toxicology analysis was negative.

3. Discussion

Hanging is a form of ligature strangulation in which the force applied to the neck is derived from the gravitational forces of the body or a part of the body. Hanging is often suicidal, rarely accidental and exceptionally criminal ("lynching").[1]

Figure 8 The cervical ligature mark in case n°2.

Figure 9 The cervical ligature mark with an ecchymotic abrasion just behind the right ear.

In Tunisia, there are no records of fatal accidental hanging. It only represents 3% out of 200 cases of hanging autopsied in the department of legal medicine of Sfax (Tunisia) during 2014. Zemni and al found only 2% out of 250 cases of hanging autopsied in the department of legal medicine of Sousse (Tunisia) for 15 years.[2] According to Davison (1989), it would represent about 5% of the hangings.[3]

Accidental hanging concerns children as well as adults, it may occur while playing or at work, and in auto erotic or intoxication context. It is seen with children while playing or with athletes who are in the habit of exhibiting hang. Workmen falling from scaffolding may be hanged by ropes.[4]

There are independent or synergistic mechanisms, by which accidental hanging may cause death. These include: stretching of the carotid sinus causing reflex cardiac arrest; occlusion of the carotid (and possibly vertebral) arteries; venous occlusion; airway obstruction resulting from pushing the base of the tongue against the roof of the pharynx or from crushing the larynx or trachea; and finally spinal cord-brainstem disruption.[1]

Various atypical forms of hanging occurring accidentally have been described in the literature. Schematically, the survey of these hangings is made according to the age of the victim and the circumstances leading to their death.[5]

3.1. Among children

Pediatric hanging is unusually suicidal[6] and occasionally accidental[7]. The child's accidental hanging is much less frequent among small children who, in general, trap their heads involuntarily in surrounding elements. It can be the constituent structure of the bed or the pram,[8] a cord attaching a dummy to the baby's neck and which is caught-by an element of the bed,[9] a manipulated electric window of a car,[10] entanglement in clothing,[11] etc.

Hanging ranks fourth in the causes of unintentional injury for toddlers. It is exceeded by motor vehicle accidents, drowning and burns[12]. Rauchschwalbe documented 183 fatal window cords hangings in the United States over a 14-year period with children between 1 month and 8 year-old. Ninety-three percent of the victims were 3 year-old or younger.[13]

Accidental hanging is more common among the older children. Hanging as well as entanglement occurs mostly with a child older than 6 months.[14] It occurs usually with playground equipment[15]. Tinsworth and McDonald estimated that in 1999 more than 200,000 playground equipment-related injuries were treated in U.S. emergency departments. One hundred and seven playground related fatalities were documented (0.07% of all playground related injuries) over an 18 month period. Fifty percent of these fatal injuries were due to asphyxia secondary to hanging and strangulation. One-third of the victims were younger than 5 years and 80% under 10 years.[16,17]

Our first case concerned a seven-year-old girl. Hanging occurred while she was playing with the rope. The autopsy in this case confirmed the asphyxia syndrome associated with lesions in the soft tissue of the neck without laryngeal fractures, it concluded to the death by incomplete hanging. The mechanism of death was twofold: cardiac arrest due to massive vagal reflexes by the stretching of the carotid sinus (Fig. 6) that

explains the immediate death and secondary airway obstruction explaining the asphyxia syndrome described by the autopsy. Pressure on the carotid sinus sympathetic ganglion (carotid body) in the neck is well known for producing bradycardia and cardiac arrest. The role that this reflex plays in the pathophysiology of hanging is believed to be uncommon, as a force must be applied to a specific and localized area,[18] and while bradycardia can occur within seconds, the force must be maintained for a minimum of 3–4 min to induce cardiac arrest.[19] Although it is assumed that mechanical constriction of the air way is the major mechanism of death in children after strangulation by hanging,[20] acute pulmonary oedema is possible and it can be caused by neurogenic factors and negative intrathoracic pressure.[21] In the literature, since 1856 lots of forensic reports, concerning trauma of the hyoid bone and laryngeal cartilages in hanging, have been published.[22,23] Frequency of these injuries ranges from 0% to 83.3%.[24] The presence of laryngeal fractures depends upon multiple factors including age and complete or incomplete hanging.[25] A higher prevalence of fractures is linearly correlated with higher age due to the ossification of these structures and thereby losing elasticity.[25] It is suggested that laryngeal fractures do not occur to the patients under the age of 25 years after hanging.[26] The accidental aspect was admitted after a survey of the circumstances, the police investigation and the autopsy results.

3.2. Among adults

Almost adult hangings cases are suicidal, it is the second or third choice method employed in most of the countries.[27] It is the first mechanism of suicide in Tunisia. Adult accidental hanging is uncommon. It can be « voluntary » or « involuntary ».[28]

The adult's accidental hanging can be ''voluntary'', such as in autoerotic asphyxia,[29] but the victim does not expect the death. Autoerotic asphyxia (hypoxyphilia) is a form of sexual masochism characterized by the use of self-strangulation up to the point of loss of consciousness in order to enhance sexual arousal.[30–33] The most frequently encountered method of typical autoerotic activity is asphyxia by hanging.[34] Several cases of autoerotic hanging have been reported in the literature but no one occurred in our country. In the literature some criteria for diagnosing an autoerotic death have been proposed: (1) a well-defined self-rescue mechanism for obtaining sexual arousal, (2) autosexual activity, (3) sexual fantasy aids (such as pornographic materials), (4) previous autoerotic practice and (5) no previous suicide attempts.[32,33]

The adult's accidental hanging can be really ''involuntary''.[28] The most frequent cases reported were in relation with professional or leisure activities (parachuting, mountaineering, etc.). Hangings by the seat belt[35] or the electric window of the cars have also been reported.[36] Other circumstances have been described as accidental hanging like compressing the neck between the side bars of a bed in elderly subjects affected by neuropsychiatric pathologies.[37] In 2002, Nurhantari and et al. described a case where a 61-year-old man was found dead in the sitting position with the collar of his sweater hanging off the break handle of a motorcycle.[38] Later, Salem and al reported an accidental hanging by the collar of a shirt fixed on the top of an iron rod.[39] In both cases, the decedents were extremely intoxicated with alcohol.[38,39] Kodikara and Alagiyawanna report unusual accidental hanging of a 25-year-old man, who was in a state of morphine-induced central nervous system depression and found dead in a sitting position with the collar of his T-shirt hanging off a jutting out root of a tree. The hanged collar acted as a ligature compressing the neck.[40]

In our second case, the circumstances of the accidental hanging were strange. The examination of the death scene and the autopsy findings associated with negative toxicology assessment led to the diagnosis of the accident. The deceased had no psychiatric illness or previous suicide attempts and had no expression of suicidal ideation with any potential stressors at the moment of death. In addition, the history and the circumstances were inconsistent with suicide. Therefore, the absence of other traumatic lesion notably defensive wounds or trauma on the head or the back, and the absence of chemical submission support the likeliest hypothesis: ''the panic, fear, and probably muscular exhaustion would have been associated and could explain the inability of the victim to free himself from the metallic bars of the door''.

In fact, vital neck injury and marked asphyxia syndrome suggest that death was due to mechanical asphyxia by neck compression. The diagnosis of positional asphyxia was initially discussed. In the literature, the diagnosis of positional asphyxia is essentially based on 3 criteria: (1) the body position must obstruct normal gas exchange; (2) it must be impossible to move to another position and (3) other causes of natural or violent death must be excluded.[41] In the present case, the fact that body position did not obstruct normal gas exchange and the presence of a rising ligature mark on the neck excludes postural asphyxia.

4. Conclusion

Hanging is one of the common methods of committing suicide. It is considered suicidal unless the contrary is proved. Accidental hanging is rare across all age groups, and it is even rarer in the adult population except in autoerotic context. The study of the death scene, the forensic autopsy findings, the toxicology analysis and the study of the circumstances of death are essential for the diagnosis of the medico legal form.

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Conflict of interest

None declared.

Ethical approval

Necessary ethical approval was obtained from the institute ethics committee.

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